R E P O R T R E S U M E S

ED 003 450 24

PILOT PROJECT FOR DEVELOPMENT OF A DEVICE TO FACILITATE LEARNING OF BASIC MUSICAL SKILLS.

BY- LABACH, PARKER
KENT STATE UNIV., OHIO

REPORT NUMBER CRP-S-051 PUB DATE 65
EDRS PRICE MF-$0.09 HC-$2.28 57P.

DESCRIPTORS- *HIGH SCHOOL STUDENTS, *ELEMENTARY SCHOOL STUDENTS, *MUSIC EDUCATION, MUSIC TECHNIQUES, *TAPE RECORDERS, *TAPE RECORDINGS, KENT, OHIO

UTILIZING TAPE RECORDERS AS MAJOR COMPONENTS, THE INVESTIGATOR DEVELOPED A DEVICE TO FACILITATE LEARNING OF BASIC MUSICAL SKILLS BY PROVIDING FOR REPLAY OF RECORDED SEGMENTS OF PRACTICE FOLLOWING THE "LIVE" PERFORMANCE AND BY PROVIDING A MODEL PERFORMANCE FOR COMPARISON. STUDENT USE OF THE DEVICE DURING THE LIMITED PILOT PROJECT INDICATED THAT DEVICES OF THIS KIND ARE NOT ONLY FEASIBLE BUT ALSO HAVE POTENTIAL FOR MUSIC TEACHING. AS THE NEXT STEP, THE INVESTIGATOR RECOMMENDS CONTROLLED EXPERIMENTATION WITH AN EMPHASIS ON PROGRAMED MATERIAL, VARIOUS MODES OF PRESENTATION, AND LONG TERM RESEARCH DESIGNS. (JC)

U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
Office of Education
This document has been reproduced exactly as received from the person or organization originating it. Points of view or opinions stated do not necessarily represent official Office of Education position or policy.

PILOT PROJECT FOR DEVELOPMENT OF A DEVICE TO FACILITATE LEARNING OF BASIC MUSICAL SKILLS

Cooperative Research Project S-051

By

Parker LaBach
Kent State University
Kent, Ohio

1965

The research reported herein was supported by the Cooperative Research Program of the Office of Education, U.S. Department of Health, Education and Welfare

ED 003450

TABLE OF CONTENTS

The Problem 3

Objectives 8

Related Research 10

Procedures 16

Results 24

Conclusions and Implications 26

Appendix A: Summary of Student Practice . 38

Appendix B: Selected Examples of Programed Material . . . 45

Appendix C: Diagrams of the Practice Device 53

THE PROBLEM

The problem considered in the research reported here was the development of an electronic practice device which would facilitate the learning of certain basic musical skills. It was planned that this device, programed with suitable practice material, could be easily and profitably used by a variety of music students.

The basic idea embodied in the practice device is that students may practice more effectively if they can make immediate aural comparison between their own practice performance and a prerecorded model performance of the same material. In order that this may be done, the material must be divided into suitable small segments, and means provided for playing, hearing and comparing without the necessity of operating complicated mechanisms during the procedure. Thus the device is a kind of teaching machine utilizing the element of sound, and requiring automatic operation of electronic components in conjunction with prepared programed material.

The present project was aimed primarily at developing equipment and procedures which may prove useful in the elementary and secondary schools when used by young

instrumentalists as a practice aid. Some of the factors which may be cited for this decision are the following:

1. Individual practice by school instrumentalists receiving periodic group lessons in school is often a haphazard affair; the teacher may not meet with the student frequently enough to keep adequate check on his progress and practice habits.
2. Students practicing at home often get little positive help or criticism from parents whose knowledge of music may be small.
3. The teacher is often not a competent performer on some of the instruments which he, nevertheless, must teach; thus he may be unable to demonstrate proper tone and technique in a lesson.
4. Students left alone to practice individually often waste time, fail to keep a good tempo, misplay rhythms, and repeat errors unknowingly.
5. Lesson time may be so limited as to preclude adequate explanation or demonstration of new material to be practiced.

The projected electronic practice device, then, was

planned as a means of alleviating some of these difficulties encountered by many young school musicians. Although a teaching machine in the technical sense, and capable of being programed in many ways, the device was not intended to supplant the teacher's function; rather it was hoped that, with suitable material, it could be used to supplement and reinforce the teacher's efforts, enable individual students to concentrate on individual problems, and thus perhaps make practice both more meaningful and more enjoyable.

Since the study necessarily was restricted in time and scope, the following specific aspects of the problem were considered, with the limitations indicated:

1. The first task was the design and construction of the device itself. This undertaking provided the major difficulties. Understandably, the feasibility of the practice device had to be established before a meaningful investigation of programing or an evaluation of its use as a teaching device could be undertaken. It was also considered that the device itself, once put into experimental operation, could in a sense "suggest"

its own uses; this, indeed proved to be true.

2. The device, as planned, could be used in the practice of any type of musical material, played or sung by any individual performer. Thus an infinity of possible programs could be composed or arranged and prerecorded for use with the device. For practical reasons[1], material was prepared by the investigator for cornet (trumpet) and clarinet students, gauged to the level of those students available to use it. It is realized, of course, that the appropriateness of this practice material to the needs and aims of the student is a vital link in the process, and that different programing by different teachers can have a substantial effect on the utility of the device. Within the confines of this pilot project, the investigator can discuss the use of his own limited material only, and, beyond that, can make educated speculations about the numerous possibilities of other kinds of material and programing techniques.

---

[1]The Kent State University School, having a small enrollment, had a larger number of cornet and clarinet students to work with than those playing other instruments.

3. After the decision was made to prepare material for cornet and clarinet, there was no further attempt to select or group students. All available cornet and clarinet students in the Kent State University School were scheduled to use the device. No attempt was made to regulate any other musical activities (lessons, practice, band participation, or the lack of these) of any of the students; the limited number of students and the great variety among them tended to make such controls valueless. Thus, the students' use of the device was studied through the observation of individual cases and problems, with considerable subjective but nonetheless pertinent evaluation of the device's uses and possibilities included.

The problem, then, became that of constructing a device of many potential uses, and of investigating the feasibility of the device to the extent possible in a pilot project. The hoped for results were a better orientation towards further research and more sharply defined implications for long range study of the uses of electronic practice devices in music learning situations.

OBJECTIVES

The Planned Functions of the Device

The device was planned to meet the following requirements:

1. It should make provision for the student to hear a recording of segments of his practice in the nearest possible time relationship to corresponding segments of his "live" performance.
2. It should provide the student with a model performance of segments of practice material immediately available with which to compare his own performance.
3. It should be automatic; that is, it should be simple for the student to use easily and naturally, incorporating no complex controls, manual switching, or tape rewinding. The student should merely turn it on and practice.
4. It should be adaptable to a wide variety of programing, including material at all levels, of all types, and for any instrument.
5. It should help the student pace his practice, keep accurate tempos, and avoid wasting time.

6. It should provide an interesting and challenging mode of practice, enjoyable to the student.

Hypotheses

The original hypotheses set up for investigation were that

1. The practice device could be constructed to fill its specified functions, and the electronic and mechanical operation would be dependable and durable.
2. The student subjects using the equipment for regular practice would make significantly better progress in the acquisition of basic musical *skills* than they would make without its use; and that
3. Students using the equipment would prefer practicing with its aid over practice without it.

Briefly stated, the hypotheses expressed the investigator's assumption that the device would prove technically feasible, educationally advantageous, and pleasant to use.

RELATED RESEARCH

Programed instructional or practice devices for music teaching can be considered within one of two general groups; (1) the programed textbook type, in which the element of sound is absent; and (2) the more sophisticated or complex device, usually involving tape transports, amplifiers, microphones, signal systems, and other electronic machinery, in which the element of sound can be a part of the learning situation.

The first type, several of which are commercially available, is suitable for the teaching of some facts and concepts, such as musical terminology and notation. Several research projects (Barnes, Hargiss) have been devoted to determining the efficiency of learning in this way, with promising results indicated.

The second type of device, that involving sound itself, presents many more complex problems in design; however, the potential value and range of uses for such devices seem to be far greater than those of the programed book. Since most actual musical learning involves the production and evaluation of musical sounds, any wide

application of programed instruction to music must include sound itself.

However, apart from the electronic design difficulties inherent in such sound utilizing devices, the following factors must be considered by any researcher in the field:

1. No device can be better than its programed material; the suitability of the material to desired learning goals, the factors of differing modes of stimulus and response, step size, feedback and retention of learning present an array of variables demanding long range testing and evaluation before the utility of any programed learning device can be ascertained.
2. Many different but interdependent elements are present in even the simplest musical expression - tone, rhythm, tempo, pitch, dynamics. The isolation of elements sometimes seen as desirable in constructing a simple, logical, easily tested program is difficult.
3. It is difficult to adjudge a musical response as "correct" or "incorrect"; rather, the response is often more or less good, appropriate, or

skillful. All performance skills present this difficulty in programing.

Experimentation with programed practice devices incorporating musical sound for stimulus and/or response is comparatively recent. Noteworthy is the work of Spohn (17; 19) and his colleagues in developing automated techniques for teaching aural comprehension to music theory students, and that of Ihrke (7; 8) with the problem of reading rhythm patterns.

The current state of research in programed music instruction is such that prospects for its growth and eventual great value are promising. There is much yet to be done in determining just what aspects of music instruction can best benefit by being programed, and then in creating and testing the necessary devices and programs to accomplish the desired results.

References

1. Barnes, Robert A. "Programed Instruction in Music Fundamentals for Future Elementary Teachers," Journal of Research in Music Education, XII, No. 3 (Fall, 1964), 187-198.

2. Carlsen, James C. "An Investigation of Programed Learning in Melodic Dictation by Means of a Teaching Machine Using a Branching Technique of Programing." Doctoral Dissertation, Northwestern University, 1962. Ann Arbor: University Microfilms, Mic. 63-1274.

3. Carlsen, James C. "Implications of Recent Research Problems in Programmed Music Instruction," Bulletin of the Council for Research in Music Education, No. 4 (Winter 1965), 30-35.

4. Coulson, J.E., and Silberman, H.F., "Results of an Initial Experiment in Automated Teaching." Teaching Machines and Programed Learning (edited by A.A. Lumsdaine and Robert Glaser). Washington: National Education Assoc., 1960.

5. Goldiamond, Israel, and Pliskoff, Stanley. "Music Education and the Rationale Underlying Programed Instruction," Music Educators Journal, Vol. 51, No. 4 (February-March, 1965), 43-47.

6. Hargiss, Genevieve. "The Development and Evaluation of Self-Instructional Materials in Basic Music Theory for Elementary Music Teachers," Bulletin of the Council for Research in Music Education, No. 4 (Winter 1965), 1-5.

7. Ihrke, Walter R. "Automated Music Training," Journal of Research in Music Education, XI, No. 1 (Spring, 1963), 3-20.

8. Ihrke, Walter R. "Automated Music Training," Bulletin of the Council for Research in Music Education, No. 2 (Winter, 1964, 6-8.

9. Ihrke, Walter R. "Trends in Music Education Research," Bulletin of the Council for Research in Music Education, No. 2 (Winter, 1964) 29-31.

10. Koskey, Eugene. "A New Visual Technique for Music Education," Music Educators Journal, Vol. 51, (February-March, 1965), 51-52.

11. LaBach, Parker. "A Device to Facilitate Learning of Basic Music Skills," Bulletin of the Council for Research in Music Education, No. 4 (Winter, 1965), 7-10.

12. Leonhard, Charles. "Newer Concepts in Learning Theory As They Apply to Music Education," Bulletin of the Council for Research in Music Education, No. 1 (June, 1963), 24-31.

13. Morton, F. Rand. :The Language Laboratory as a Teaching Machine: Notes on the Mechanization of Language Learning." Laboratory Conference held at Indiana University, January 22-23, 1960. Indiana Research Center in Anthropology, Folklore, and Linguistics, Publication 14. Bloomington: Indiana University, 1960.

14. "Research Projects in Music Supported by the U.S. Office of Education," Music Educators Journal, Vol. 51, No. 3 (January, 1965), 38-39.

15. Shetler, Donald J. "Some Problems in the Evaluation of the New Teaching Media," Bulletin of the Council for Research in Music Education, No. 2 (Winter, 1964), 23-28.

16. Silberman, Harry F. "Self-Teaching Devices and Programed Materials." Review of Educational Research, Vol. XXXII, No. 2. Washington: American Educational Research Assn., April, 1962.

17. Spohn, Charles L., Jr. "An Exploration in the Use of Recorded Teaching Material to Develop Aural Comprehension in College Music Classes." Ph.D. dissertation, the Ohio State University, 1959. Ann Arbor: University Microfilms, Mic. 59-5941.

18. Spohn, Charles L. "Music: An Important Subject for Learning Research," Bulletin of the Council for Research in Music Education, No. 1 (June, 1963), 11-17.

19. Spohn, Charles L. "Research in the Use of Self-Presentation Materials: Implications for the Improvement of Instruction in Music Theory." Paper presented at the national convention, Music Educators National Conference, Philadelphia, March 13-17, 1964.

20. Stolurow, Lawrence M. "Program and Programing Process." Teaching by Machine. Cooperative Research Monograph No. 6, Chapter V, pp. 60-84. Washington: U.S. Department of Health, Education, and Welfare, Office of Education, 1961.

21. Van Mondfrans, Adrian P. and Travers, Robert M.W. "Paired-Associate Learning Within and Across Sense Modalities and Involving Simultaneous and Sequential Presentations." Am. Ed. Research Journal, II, 2; (March, 1965) 89-99.

PROCEDURES

Design of the Practice Device

The Component Parts - All of the components of the device are commercial units or circuits which have been modified so that they are interconnected and can be controlled automatically. The principal component parts are: one Magnecord Recorder Model 1022P, one PR-4 cartridge tape machine (later replaced by a Viking Cartridge tape deck Model 38 and the associated amplifier, RP-83), one Knight 12 watt amplifier, one Electro-Voice Microphone 654A, one Electro-Voice Wolverine LT-12 Speaker, plus relay circuits. The control amplifier and oscillator circuits incorporate no new designs but have been modified to suit the needs of this application. The total machine as a system is an innovation and original with this research (See Appendix C, Figure 2 page 54). The components were mounted on a rack 77 inches high and 19 inches wide, as shown in Appendix C, Figure 3 page 55. The entire device is mounted on casters for ease in moving. It should be emphasized that the size and weight of the experimental device would not have to be duplicated in future construction. Moreover, the device could be constructed on separate chassis for easy portability.

The Operation of the Device. The device was planned to be used with especially prepared practice material. Each page of material[1] was divided into segments of equal duration. In practicing a page of material, it was considered that any of the three following modes of operation could be utilized:

Figure 1

Mode I	Student plays	Student hears playback of his performance	Student hears prerecorded model performance	Process continues with remaining material
Mode II	Student hears prerecorded model	Student plays	Student hears playback	Process continues
Mode III	Student hears prerecorded model	Student plays	Student hears playback	Student again hears model performance	Process continues

The operation of the device would thus require (1) a tape containing a pre-recorded model performance of the segmented material; (2) provision for recording and playing back the student's practice of the material; (3) automatic switching mechanisms necessary to continue the sequence of practice (Mode I, II or III) without the necessity of any manual

[1]Several pages of typical practice material are included in Appendix B, page 38.

operation of the controls.

The required operation was achieved by (1) utilizing the standard tape recorder for the pre-recorded material plus periodic subsonic (20 cps) prerecorded switching signals for actuating relays to operate all controls, and (2) utilizing the tape cartridge machine, loaded with a measured loop of tape, for the student record and student playback functions.

The design of the device allowed the use of practice segments of any timed length providing that this segment length (called hereafter the interval) remains the same within any single master tape and corresponding page of practice material. The desired interval is calculated in the preparation of the material and the master tape is recorded with switching signals added accordingly. The appropriate tape cartridge for student record and student playback contains a loop corresponding to this interval.

Material was prepared and recorded using intervals of 6 seconds, 10 seconds, and 16 seconds. Cartridges were prepared with corresponding loops of 45 inches, 75 inches, and 120 inches, the necessary lengths for a tape speed of 7½ inches per second. Most material was prepared using the

two smaller time intervals since it was reasoned that less value would be gained with longer segments where the factors of immediate playback and direct aural comparison tend to lose meaning and impact. Generally, segments of a phrase or less were considered most suitable.

Preparation of the Programed Material: All material used was composed or adapted by the chief investigator, and is considered comparable in style and type to much of the material published in standard method books. Most of the exercises were intended for elementary and intermediate students such as those who were actually available to use it. Each practice tape (corresponding to one page of exercises) was intended to introduce or emphasize a particular problem, such as slurs, staccato, specific note values or rhythm patterns, specific keys or time signatures. The number and kinds of exercises and problems that could be prepared for this specific pilot study was obviously severely limited, but it should be realized that there is no practical limitation whatsoever to the repertoire that can be prepared.

Recording the Programed Material: Professional players (trumpet and clarinet) were used to make the model recordings which were made on the device itself, using Channel 1

of the model 1022 recorder. In addition to the player, a recording "engineer" was required to keep time and record the periodic subsonic switching signals at the predetermined interval. These signals were generated in the device itself by using a simple manually operated push-button. Time was kept by a Kodak darkroom timer. During the recording sessions it became obvious that the recordings could be made by the player alone and unassisted if an automatic electronic timing and signal stamping mechanism could be incorporated into the device. Moreover, the timing accuracy could be made more exact in this way. It is planned that in future use such a mechanism will be added.

The majority of tapes were recorded using Mode III (i.e., each segment was recorded twice, with intervals allotted between for the student record and playback functions). Mode III was considered to be particularly useful for the beginning and elementary student. More advanced material was recorded using Modes I and II. Each tape was labeled with its reference number, segment time interval, and recording mode.

The Device in Practice: The automatic operation of the device utilized three distinct functions in sequence, with

switching from one to the next controlled by the prerecorded subsonic signals on the master tape. These functions are as follows:

1. Master play - A segment of the prerecorded model performance is played. (A green signal light on the front panel indicates the function.)
2. Student record - The student plays the segment just heard. It is recorded on the loop in the cartridge recorder. (A red light indicates this function.)
3. Student playback - The student hears his own performance on the loop played back. (A blue light indicates this function.)

The recorder then switches to master play and the student then either (1) hears the same segment repeated (if the recording has been made using Mode III) followed by the next segment, or (2) hears the next segment. The process then continues to the end of the tape. The subsonic signal and the relay mechanism are sufficiently audible so that the student can both see and hear when the device changes function. Both the master tape and the loop tape roll continuously, their functions being governed by the automatic mechanism. At no time does the student touch the controls.

At the conclusion the student stops both tapes with one switch.

Most of the controls can be preset and the knobs removed so that misuse or misadjustment of the device is avoided. Accidental erasure of the prerecorded material is not possible. On-off, volume, and tone control switches are all that need be used at any time.

Since master tapes and corresponding pages of practice material are labeled with the time interval, the correct loop cartridge can be selected easily before practice is started.

In the present study, student practice was scheduled in a private practice room but was monitored aurally and visually to ascertain the functioning of both student and machine. Practice tapes were scheduled by the investigator. Loading and changing of tapes was done by the investigator or an assistant. In normal use, however, there is no reason why the entire procedure cannot be carried on by students alone with minimum supervision.

There was no systematic attempt to coordinate the programed practice with any private or group lessons which any of the students might have been having contemporaneously

with the practice. The investigator was not during the course of the project the teacher of any of the students using the device although he had taught some of them previously and was well acquainted with the musical abilities of most of them. The students were shown how to use the device and then left to their own resources as to what help and self-criticism was afforded them by the practice experience.

A log of student practice was kept; in addition to practice time and materials used, student comments and problems were noted. At the conclusion of the practice sessions, students were interviewed and briefly tested on materials similar to those with which they had been practicing. The investigator's personal knowledge of the students' skills and practice habits facilitated subjective evaluation in individual cases where objective evaluation was not possible.

RESULTS

Recording and Playback - The quality of the model recordings made with the device was excellent. The only difficulty involved the critical timing necessary to properly record the switching signals. Although it proved possible to get good results with the procedure used, it was apparent that both accuracy and efficiency in recording could be gained through the automation of the timing procedure.

Student Recording and Playback - The cartridge machine originally incorporated into the device and used during experimental operation did not prove as satisfactory as the other components. Difficulty was experienced in keeping the optimum tension on the pressure pads; the continuous use of the cartridges, particularly the starting and stopping of the loop, tended to wear and sometimes damage the tape, necessitating frequent reloading with new tape. Frequency response and freedom from flutter were not up to the standard of the prerecorded model performances. After an entirely new cartridge machine (Viking Model 38 with amplifier RP-83) was substituted for the original one,

these difficulties were eliminated and the desired performance of the cartridge unit was attained.

Control and Switching Mechanism - All automatic functions operated dependably at all times. Control settings to insure proper and equal volume of sound and positive switching during the entire cycle of student operation were critical to adjust but, once set, were permanent.

Durability - During its entire period of use, the equipment experienced no malfunctions and required no repairs or adjustments except as indicated above in the case of the original cartridge machine.

Students' Reactions and Practice Results - All students accustomed themselves to the device readily. All showed at least some degree of interest, fascination or enthusiasm in practicing with the device. Information concerning eighteen students who used the device is found in tabular form in Appendix A. Generally, student practice with the device tended to indicate the probability of positive results in terms of musical skills improvement. A more detailed discussion is included under CONCLUSIONS AND IMPLICATIONS.

CONCLUSIONS AND IMPLICATIONS

1. The electronic and mechanical aspects of the practice device have proved successful; i.e., the functions of the device as envisioned at the inception of the research have proved to be capable of practical realization. However, the following qualifications and implications are pertinent:

   (a) The present device is both large and heavy; it can be easily moved along one level on casters, but cannot be easily moved to a different level or transported from place to place. Further development of the device should aim at reducing size and bulk, perhaps through transistorizing the entire circuitry or utilizing two or more separate chassis. The only justification for the size of the present device is the experimental nature of its construction, the need to allow space for work.

   (b) The present device can be effectively used by only one student at a time. It is equally feasible to provide facilities for several students,

all using the same practice material, but each located in an individual practice room. The present device could serve as a master control for any number of individual practice areas. Each individual area would then contain its own microphone, speaker, and loop tape transport and amplifier; but all would be connected by cable to the central device for all control and switching functions, and for the playing of the model performance segments. A larger power supply would be required also. Such an arrangement would allow multiple but individualized practice sessions from any programed material.

(c) In producing the master tapes with the present device, the need for an electronic timing and switching mechanism for simplifying the recording function was apparent. Such a mechanism would allow the performer to make master tapes alone without the presently required assistance of an "engineer" to keep time, give cues, and record the necessary subsonic tones for actuating the switching mechanism.

(d) As previously stated, the original loop cartridge component of the present device was not comparable to the other components in quality or reliability. Since the loop cartridge idea still seemed the best and most convenient solution for the student playback function, a replacement unit was found and installed which did meet the requirements. The performance of the device after the necessary changes were made vindicated this decision.

2. The limited use by students of the device during this pilot project can only indicate or imply results which must be further investigated in more comprehensive and controlled studies utilizing this or a similar practice device. However, based on this limited use, the following tentative conclusions can be made:

(a) The device has proven easy and pleasant to use by all students using it.

(b) There is some indication that certain basic music skills can be efficiently learned through using the device, and that, in some cases, certain skills may be far more effectively practiced with the

device than in any conventional manner. Specifically, taking up the hypothesized skills, the following conclusions may be stated:

(1) Tone quality. Although improvement in tone quality was cited by some students as a benefit they derived from the device, it is not claimed, at least in this instance, that improvement in tone is a major outcome. Since the tone quality of the tape loop playback during much of the period of student use did not adequately represent the student's actual tone quality, the student's comparison of his own tone with that of the model performance (well reproduced) could not be fully realized. Further study of tone quality improvement is necessary.

(2) Breath Control and Phrasing. Much of the material used by students consisted of segments of one phrase or less. Since the practice material was thus segmented for the student, he did not face the need of making decisions as to the location of phrase

endings or logical breathing places. However, the investigator feels that this very process of presenting the student with logically planned segments can aid the student, particularly the beginner, in getting the "feel" of a phrase as a formal unit. Students using the device did indeed consider each segment as a unit and tended to play accordingly. The fact that the allotted time for the student play allowed for no stopping or correcting of misplayed notes tended to push the student on to the end of the segment, thus giving unity to it. Whether or not the phrasing habits acquired in practicing with the device are carried over into other practice is a question yet to be properly investigated.

(3) Rhythmic Accuracy. Rhythm was most frequently mentioned by students as the musical skill most improved by using the practice device. It was apparent that most students could easily detect their own rhythmic errors, and that immediate comparison with the model

performance tended to emphasize the rhythm factor perhaps more than other factors. Since neither a metronome nor any overt counting of beats was a factor in the practice, the playing of correct rhythm involved the association of sounded rhythm patterns with the notation of these patterns. Here, the mode of presentation is of vital importance. In the case of Mode I, the student must play before hearing the model; thus, in a sense, his sight reading ability (i.e., his ability to hear the pattern when presented with the notation) is being tested. In the cases of Modes II and III, the model performance is played first. Here, the student is aided by his own tonal and rhythmic memory, and thus his practice performance is in part a rote process. The scope of the pilot study did not permit an investigation of the merits of the three modes of presentation; all were tried, although Mode III was most often used with less experienced students where it seemed

to have the most value. It is probable that all modes of presentation have value in teaching sight reading and rhythmic accuracy; but that much more investigation remains to be done. The investigator's subjective evaluation of the student's progress during the use of the device is that nearly all of the students became more aware of the necessity of rhythmic accuracy, and improved in this skill to an extent not to be anticipated without the use of the device.

(4) Appropriateness of Style, Including Articulation, Dynamics, and Tempo. Evidence indicated that certain elements of style are particularly well studied with the practice device. The concepts of staccato, legato, and the slur are easily demonstrated in the model performance. Students became accustomed to noticing marking in the score. At the conclusion of study it was adjudged that most students were more alert in perceiving indications of style and more skilled in

observing them than at the beginning.

The necessity for judging correct tempo was not a requirement in most practice material used nor were tempo changes written into any single piece of practice material. Little of the material required dynamic extremes or dynamic contrasts. Thus, these factors were not a part of the study.

(5) Accuracy of Aural Perception: In this instance, improved accuracy of aural perception would be evidenced by improved ability to play tones accurately and on pitch. There are two problems here. The first involves the ability to gauge the size of an interval accurately. The trumpet students, whose problems with this skill are commonplace, did gain in judgement of interval size. However, the ability to play individual tones with improved intonation did not appear significantly improved; certain individual's intonation problems tended to persist. Perhaps more intensive programed practice, utilizing

programed materials specifically concerned with intonation would produce significant results. In some cases, the quality of the student's instrument and its playing condition seemed significant factors.

(6) Attitude Towards Practice and the Desire to Work Methodically While Practicing. All students expressed satisfaction and enjoyment in using the device. The programed material, regardless of its simplicity or difficulty for some students was approached diligently and with enthusiasm. It was noted that interest in using the device increased rather than decreased with familiarity, and that the advantages of this kind of practice became more obvious to the student with increased use. Since the device effectively paces the student in his work, wasting time is minimized. The investigator is altogether satisfied that programed practice of this type provides both enjoyment and challenge to students using it.

(7) Ability to Read at Sight Related Material.

At the conclusion of the study, each student was asked to sight read a series of exercises analagous in content and difficulty to the material he had practiced with the machine. His efforts were compared by the investigator to his known ability in sight reading at the beginning of the study. Although no claims for precision can be made for this procedure, it is possible to state some tentative conclusions:

The ability to read music at sight is a complex of many factors - rhythm pattern perception, pitch and interval discrimination, manual technique, and others. Separating and detailed analyzing of these factors was not possible within the limits of this study. It has been indicated which musical skills seemed most likely to benefit with the practice device. Sight reading demanding any of these skills cannot, of course, be accomplished without them. Thus qualifying the question

of improvement in sight reading ability, it is not possible to do other than speculate that some observed improvement in sight reading may be due to use of the practice device. Probably the principal argument that this improvement is facilitated by the device is the logical one, that continued practice from the musical score, when subjected to continual criticism (in this case, comparison and self criticism) can produce in the student a more intelligent and efficient approach to the problem of reading the score. Much more research is required, particularly concerning the nature of the sight reading process.

(8) Comments of Students. Certain deficiencies of the device and suggestions for improving its usefulness were suggested by some students when asked by the investigator.

The major improvement, astutely realized by some students, would provide some way by which the student could reverse the device to repeat an item (segment) which had not

been played correctly. This function could be incorporated into the device using a second switching mechanism actuated by another set of pre-recorded signals and with the reversing of the master tape accomplished through a relay connected to a foot switch.

A Final Word: It must be emphasized that the device described in this report is neither perfected nor adequately tested. The work done to date, however, strongly indicates that devices of this kind are not only feasible but have potential for music teaching as yet not fully realized. As next steps, the present practice device should be subjected to controlled experimentation, with an emphasis on evaluating various types of programed material, various modes of presentation, and the results with various differing student problems and levels of student achievement. Large scale long term research designs are needed to follow up the implications of the pilot study.

APPENDIX A

SUMMARY OF STUDENT PRACTICE

APPENDIX A

Summary of Student Practice

Student	Sex	Instrument	Grade	Age	Yrs. played in school	Yrs. private lessons	Hrs. use pract. device	Remarks
A	F	C	5	10	1	0	5½	Not a strong student. Has never done adequate home practice. Willingly practiced with the device. Believes it has improved her playing. Has few comments about it. Investigator judges some improvement in rhythm and articulation.
B	M	T	5	10	1	0	3¼	Good student. Says he enjoys the device but feels "frustrated sometimes" . . . Thinks his reading has improved. Has learned some new notes and concepts (staccato) solely from the device. Does little practice at home, but work in elementary band is improving markedly.
C	M	C	5	10	1	0	5½	Fairly good student. Had lost interest in practice. Enjoys using the device, believes it helps his playing. Investigator noted moderate improvement in attention to detail, articulation, rhythm accuracy.
D	D	T	6	11	2	0	4¼	Mediocre student. Enjoys device because he can "hear the difference" . . . Thinks it helps him rhythmically. No significant change in playing noted by investigator.

Summary of Student Practice

Student	Sex	Instrument	Grade	Age	Yrs. played in school	Yrs. private lessons	Hrs. use of pract.device	Remarks
E	F	C	6	12	2	1	6	Good student; reads well (5 yrs. piano). Enjoys device, uses it intelligently; "you can see what you do wrong" . . . Thinks it improves tone quality. Effect of the device <u>specifically</u> on the student difficult to estimate.
F	M	T	7	12	3	0	7½	Good student. Enjoys device, feels it helps rhythm, counting time, reading accurately. Suggested that device would be more useful if each segment could be played twice by student (to correct mistakes immediately). Noticeable improvement in student's playing; better staccato; slurring; dotted notes; rest patterns; intervals heard more accurately.
G	F	C	7	12	3	1	3½	Poor student; careless; indifferent attitude; has had private lessons (clarinet; piano). Student not enthusiastic about device. No noticeable improvement in student's attitudes or skills, excepting possibly articulation.

Summary of Student Practice

Student	Sex	Instrument	Grade	Age	Yrs. played in school	Yrs. private lessons	Hrs. use of pract. device	Remarks
M	F	T	7	12	3	0	5½	Good student. Enjoys device; suggested that device would be better if each segment could be immediately repeated. Device appears to have aided rhythmic accuracy more than accurate judgment of intervals.
I	F	C	7	12	3	0	4	Mediocre student, weak in reading rhythms. Enjoyed practicing with the device; practiced little otherwise. Suggested that device could be easily backed up to correct mistakes. No significant improvement in skills noted during use of the device.
J	M	T	8	13	4	0	8½	Good student; very enthusiastic about practicing with the device. Enjoys playing <u>with</u> the model performances as well as in the "student record" time ("creative" attitude towards the device). Marked improvement in student's attitude and all performance skills noted during period when device was used.

Summary of Student Practice

Student	Sex	Instrument	Grade	Age	Yrs. played in school	Yrs. private lessons	Hrs. use of pract.device	Remarks
K	M	C	8	13	4	0	7	Good student. Enjoys practicing with device. Would like device to enable him to play each segment twice, or repeat at will. Significant improvements noted in fingering, rhythmic accuracy, sight reading, intonation. No improvement in tone quality.
L	M	T	8	14	4	0	7	Mediocre student, normally little inclined to practice. Enthusiastic about practicing with the device, however; believes it helps him "a little bit," particularly in rhythm. Investigator noted marked and unexpected improvement in this student, more than in any other student included: rhythmic accuracy, articulation, sight reading, tone, and (particularly) attitude towards playing.
M	M	T	9	14	4	0	3-3/4	A fair performer, no longer actively engaged in musical organizations. Practiced diligently with device during part of project. Seemed amazed that device worked as it did. Thought device aided understanding of rhythm patterns.

Summary of Student Practice

Student	Sex	Instrument	Grade	Age	Yrs. played in school	Yrs. private lessons	Hrs. use of pract. device	Remarks
N	F	C	9	14	5	1/2	5	Good student, enjoys practice with the device. Student would prefer more practice without having the model performance played first. Student believes device helps most with intonation and articulation. Student adjudged to have progressed well during period of study.
O	F	C	10	14	6	0	2¼	Most advanced player to use the device. Had no problem with the material or technique required. Enjoyed practice. Made intelligent comparison with model performance. Needed more advanced material than that available.
P	F	C	10	15	6	0	3	Good player, not active this year in school music. Enjoys practicing with the device. Suggested that tone quality of the student playback function of the machine not satisfactory; also, that more advanced students do not need model performances played first (Mode III). Believes machine helped her with rhythm accuracy.

Summary of Student Practice

Student	Sex	Instrument	Grade	Age	Yrs. played in school	Yrs. private lessons	Hrs. use of pract. device	Remarks
Q	F	C	11	16	6	1	4	Good student. Said device is "scary," but also "fun" . . . Believes she has not used device long enough to decide whether it helps her playing; also, says she does not need model performance first (Mode III). Student reads fairly well; rhythmic accuracy (a weak point) seems to be improving.
R	F	C	11	16	7	2	2	Good student. Enjoys device. Not sufficient quantity of advanced material available to challenge student effectively. Believes device most helpful to the problem of reading rhythm patterns.

APPENDIX B

SELECTED EXAMPLES OF

PROGRAMED MATERIAL

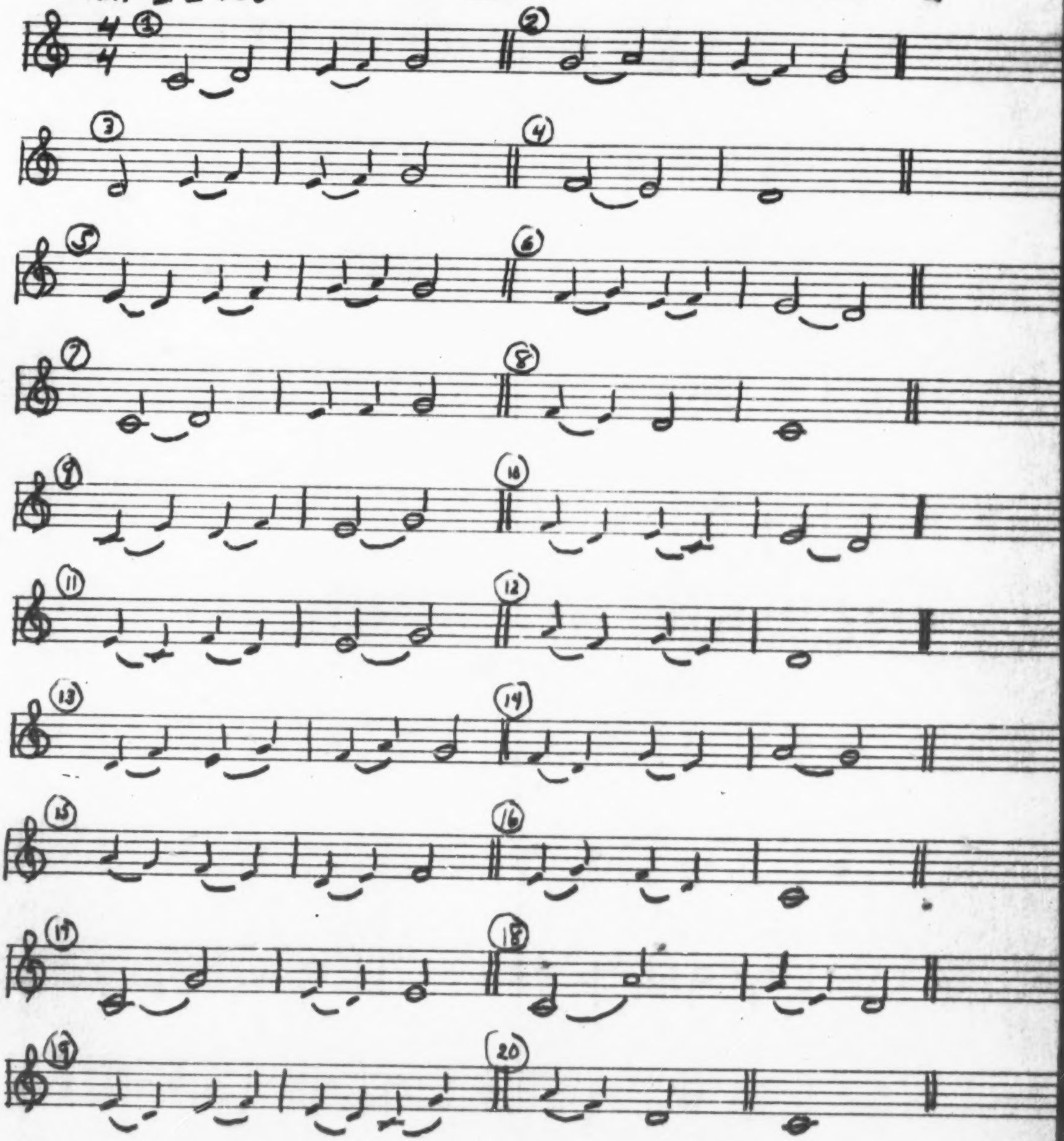
CLARINET - #22

MM: ♩ = 108

SLURS

I

INTERVAL: 6"
DURATION: 2'

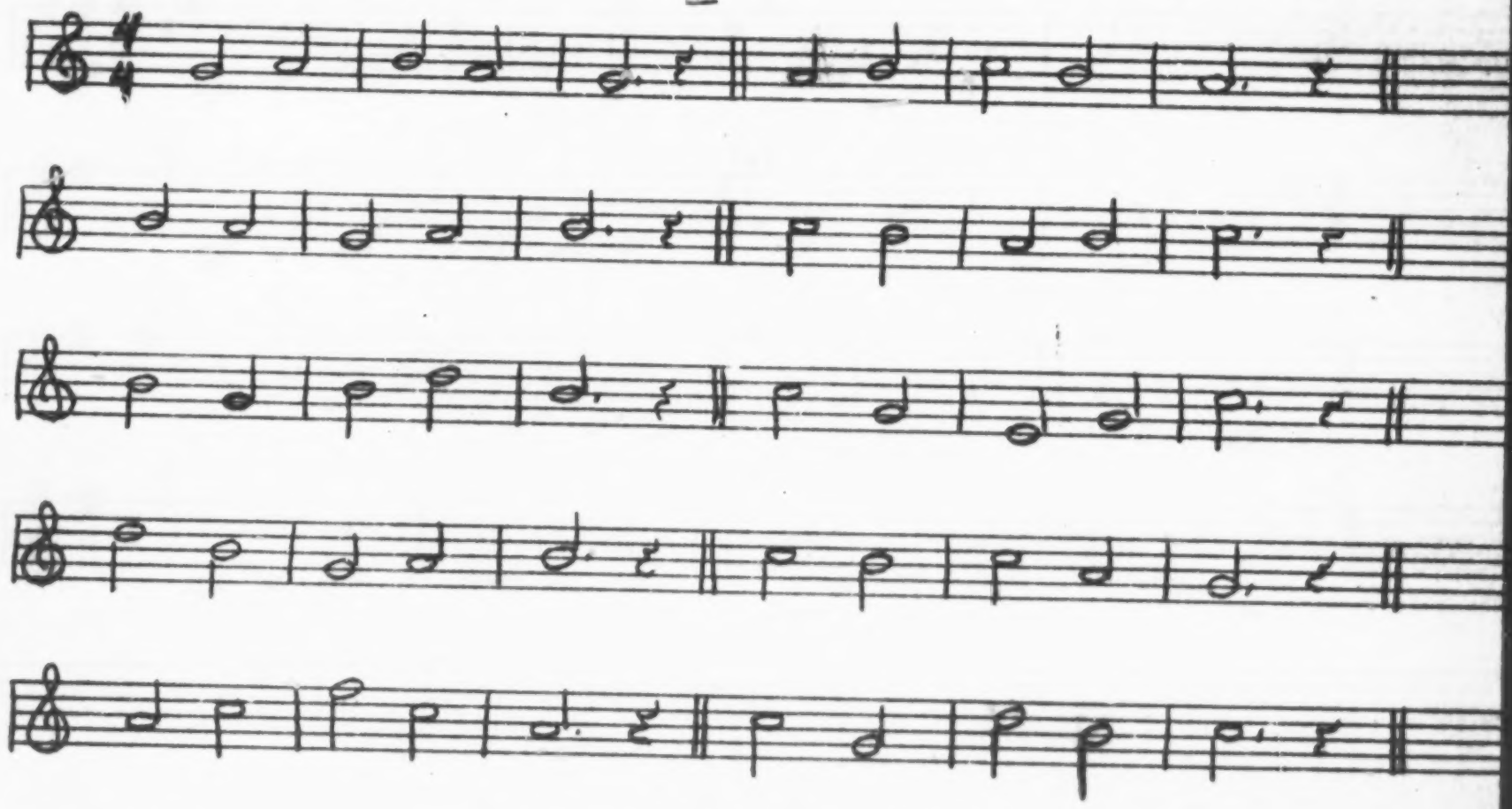


RANGE - C - G ; WHOLE, HALF, QUARTER NOTES

CLARINET - #4a REGISTER CHANGE

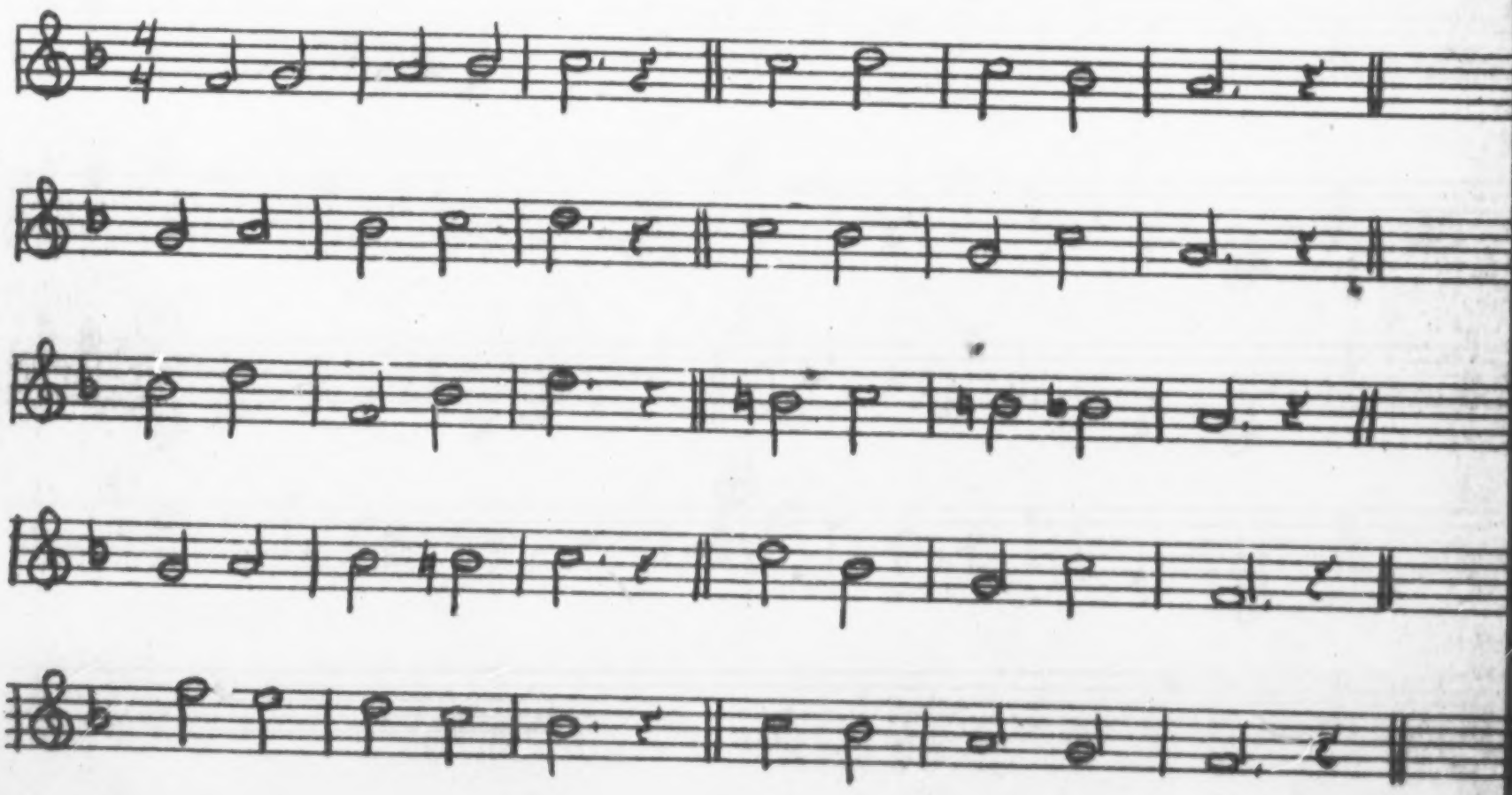
MM: ♩ = 80

I

INTERVAL: 10"
DURATION: 1'40"

CLARINET - #4b REGISTER CHANGE (B♭)

MM: ♩ = 80

II

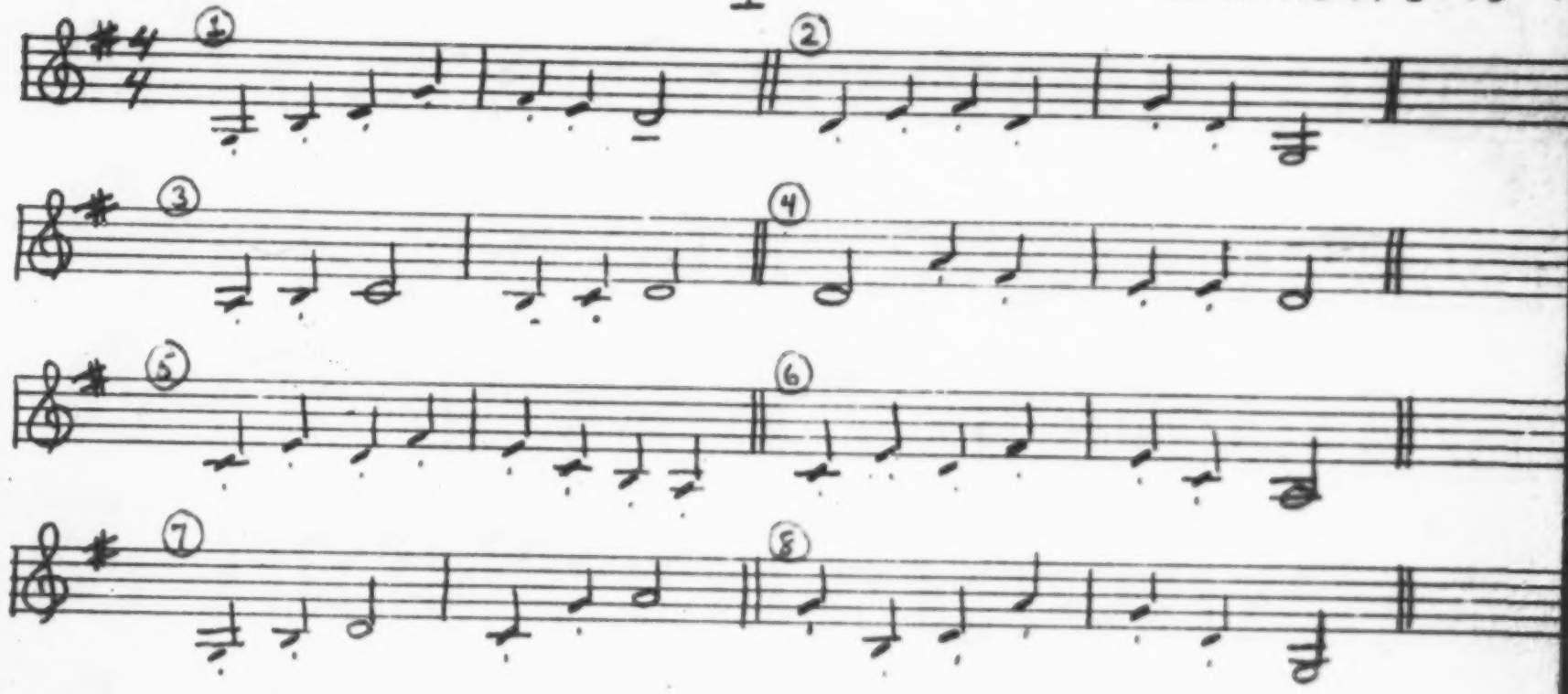
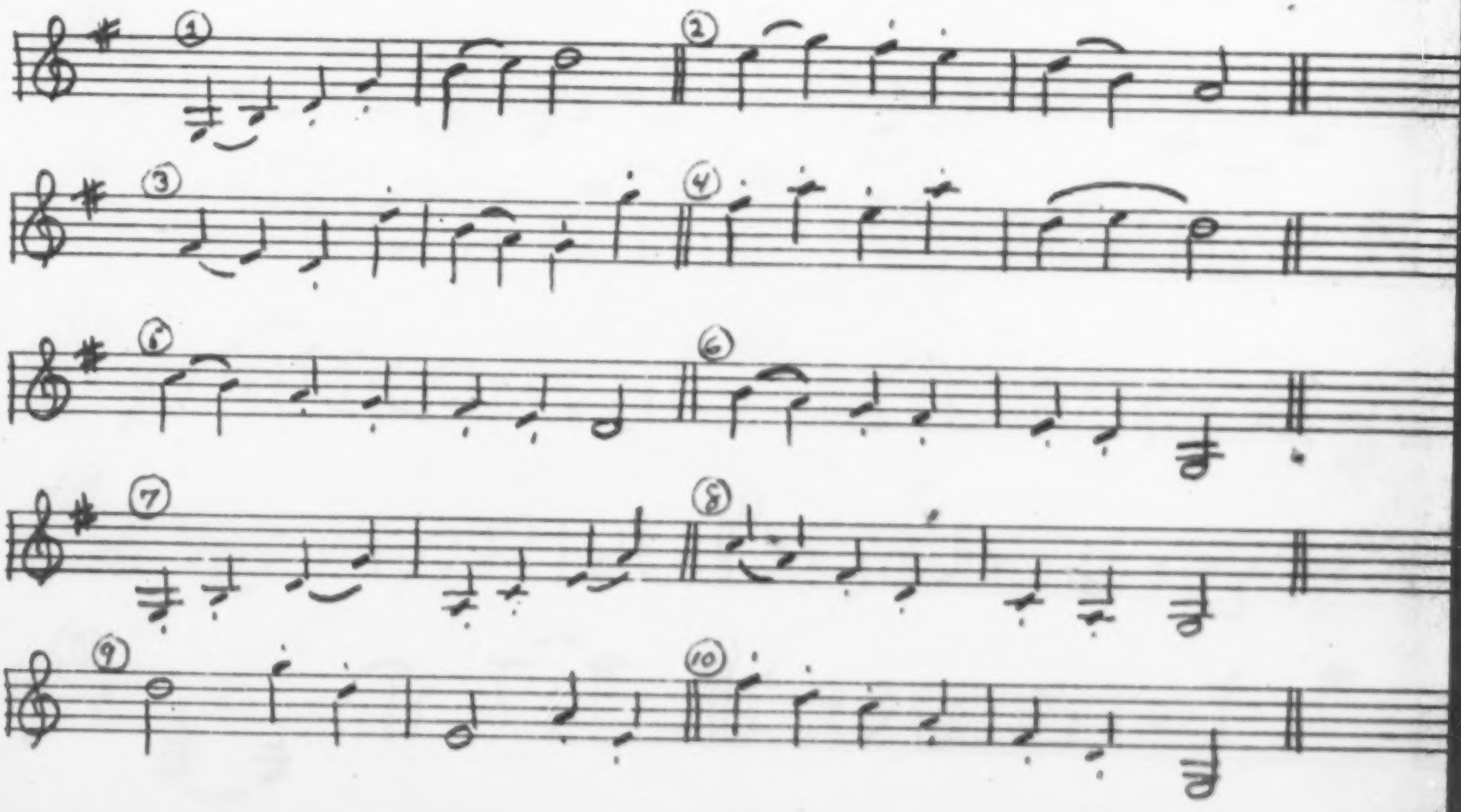
INTERVAL: (10")
DURATION: 1'40"

CLARINET - #5

MM: ♩ = 108

STACCATO

INTERVAL: 6"

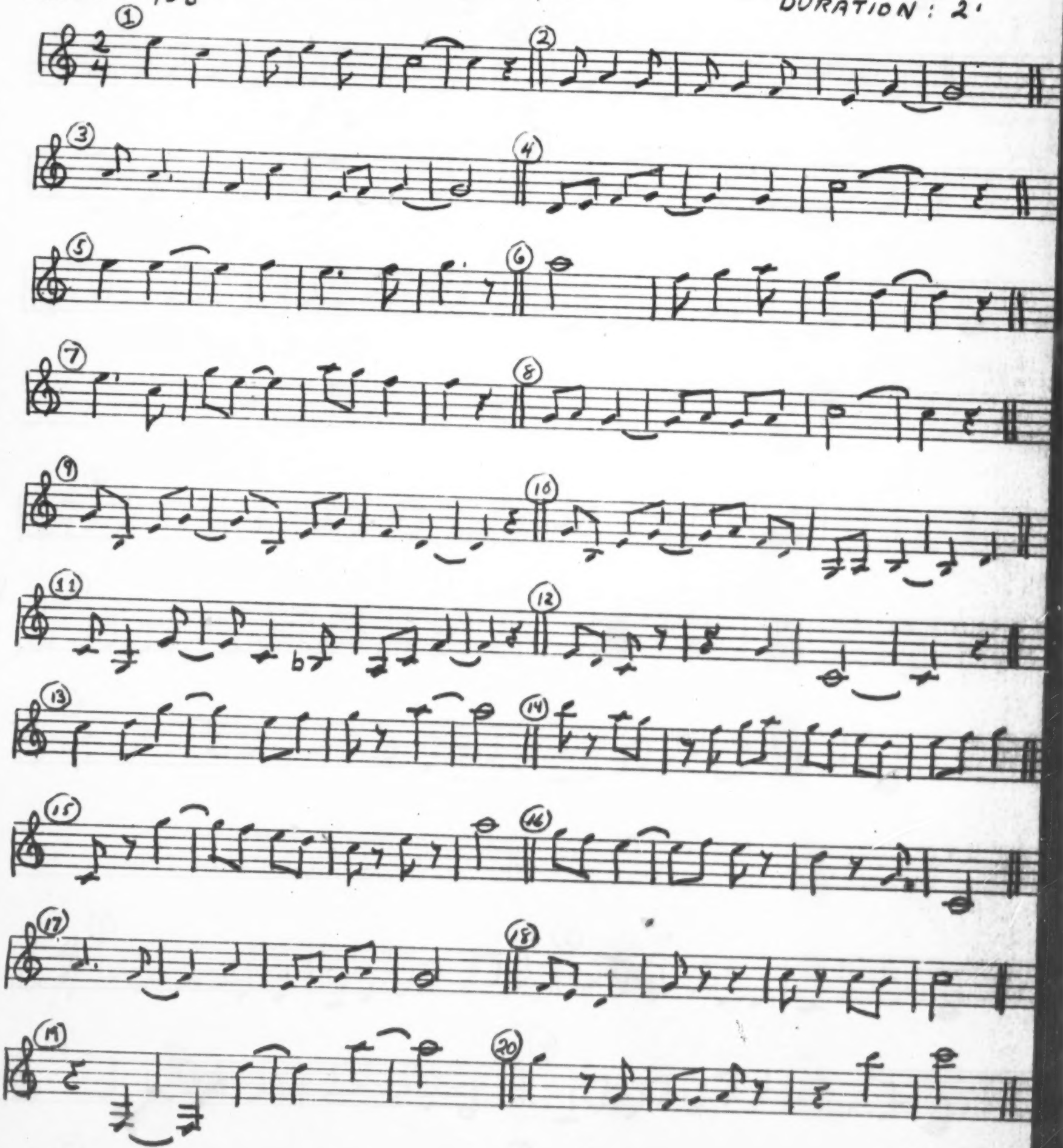
DURATION: 3'48" +

I

II

CLARINET - # 11 TIES, SYNCOPATION, RESTS, ETC.

MM: ♩= 108

INTERVAL : 6"

DURATION : 2'



TRUMPET - #5
MM: ♩ = 64

EIGHTH NOTES

INTERVAL: 10"
DURATION: 3' +

I

II

III

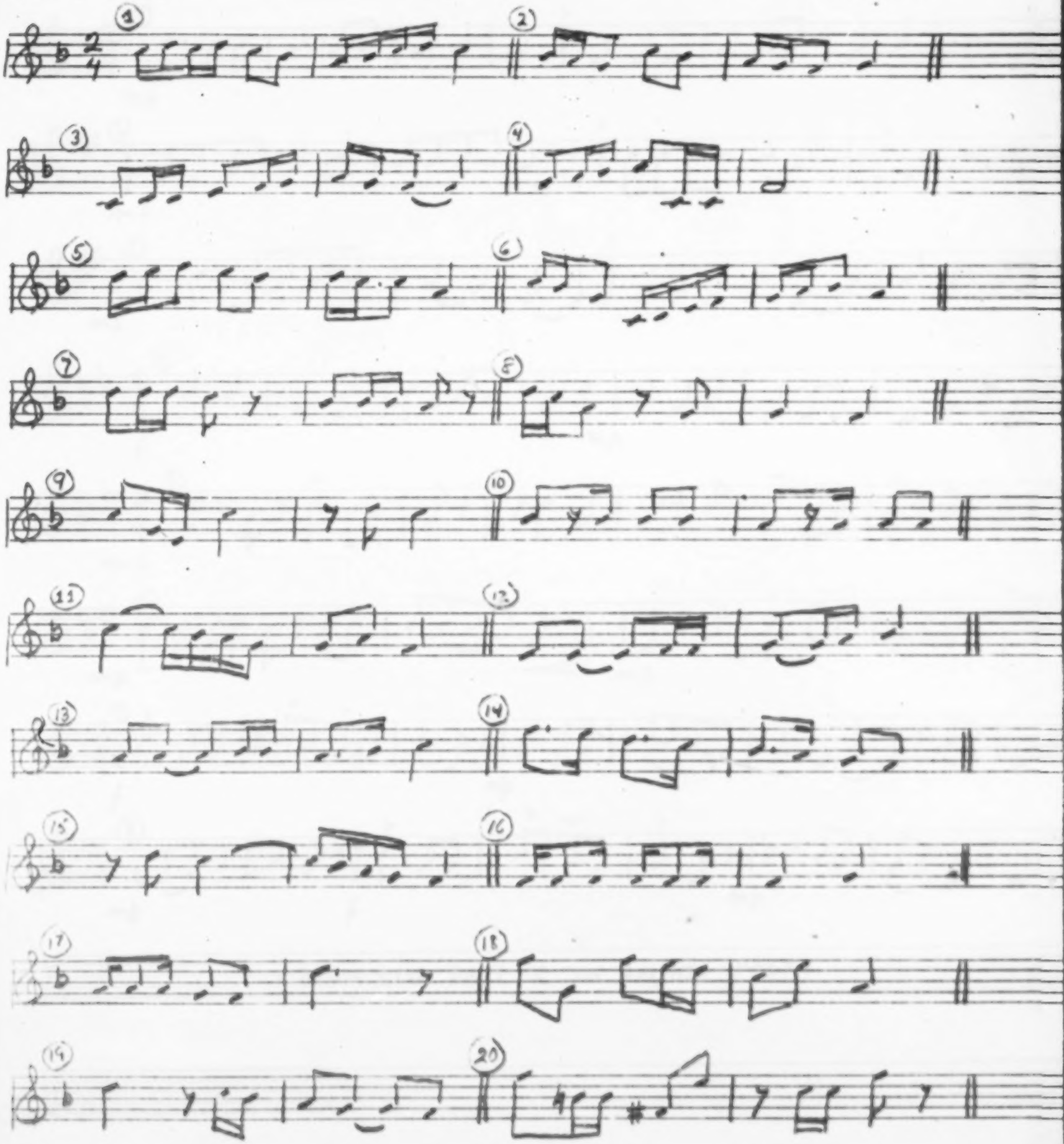
TRUMPET - #11

MM: ♩ = 66

SIXTEENTH NOTES
II

INTERVAL: 6"

DURATION: 2'



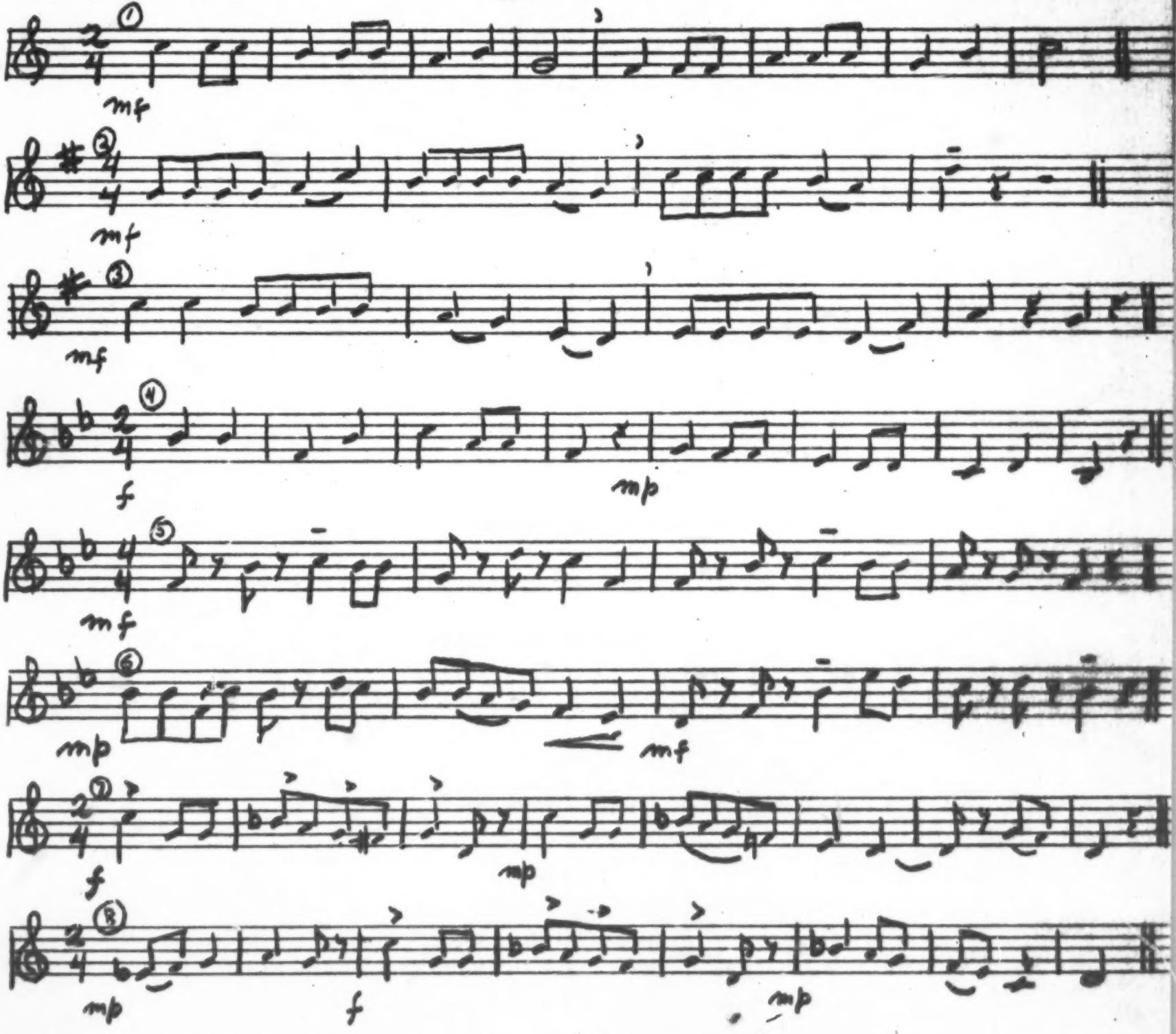
TRUMPET - #17

MM: ♩ = 108

MELODIC STUDIES (TITLE)

II

INTERVAL: 10"

DURATION: 1'20"

(BEGIN WITH PART I ON ANOTHER PAGE)

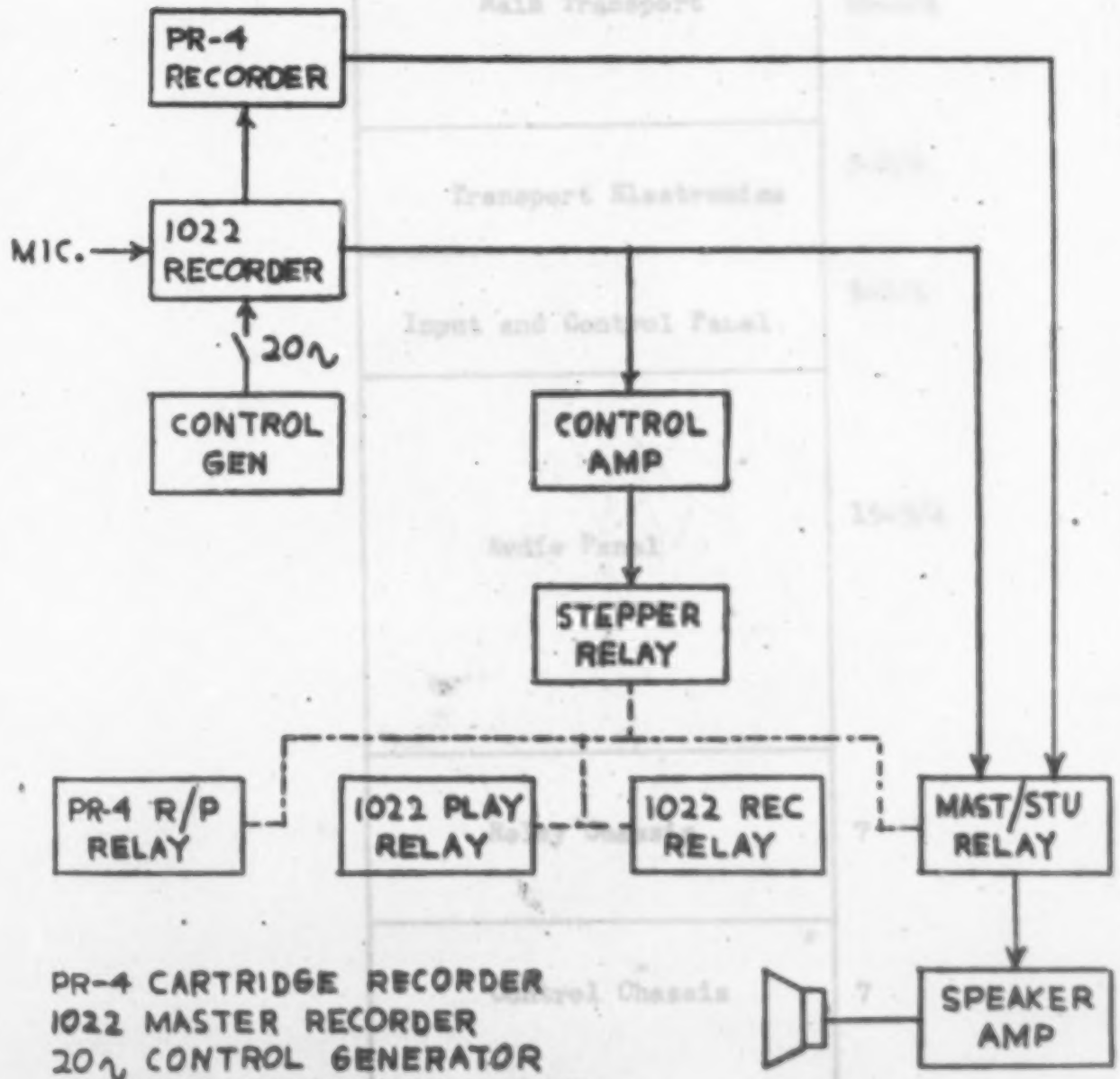
APPENDIX C

DIAGRAMS OF THE

PRACTICE DEVICE

Figure 2

KENT STATE UNIVERSITY
TELEVISION CENTER



PR-4 CARTRIDGE RECORDER
1022 MASTER RECORDER
20∿ CONTROL GENERATOR
CONTROL (SENSOR) AMPLIFIER
CONTROL RELAYS
SPEAKER-AMPLIFIER
MICROPHONE

SIMPLIFIED BLOCK DIAGRAM

ITV ENGINEERING

AUTOMATED MUSIC TRAINER
U.S. OFF. EDUC. 4-10-162
SYSTEM DESIGN BY
B. DERBY, KSU 9-1-64

RACK # Music Practice Device

19" X 14" 1/8" = 1"

Figure 3

Cartridge Recorder	8-3/4
Blank Panel	3-1/2
Main Transport	10-1/4
Transport Electronics	5-1/4
Input and Control Panel	5-1/4
Audio Panel	15-3/4
Relay Chassis	7
Control Chassis	7
Blank Chassis	7
55	